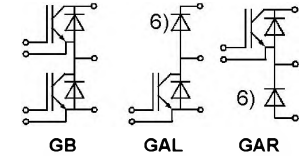


SEMİTRANS® M IGBT Modules

SKM 150 GB 123 D
SKM 150 GAL 123 D ⁶⁾
SKM 150 GAR 123 D ⁶⁾



SEMİTRANS 3



Features

- MOS input (voltage controlled)
- N channel, Homogeneous Si
- Low inductance case
- Very low tail current with low temperature dependence
- High short circuit capability, self limiting to $6 \cdot I_{cnom}$
- Latch-up free
- Fast & soft inverse CAL diodes⁸⁾
- Isolated copper baseplate using DCB Direct Copper Bonding Technology
- Large clearance (12 mm) and creepage distances (20 mm).

Typical Applications: → B 6 - 63

- Switching (not for linear use)

¹⁾ $T_{case} = 25\text{ °C}$, unless otherwise specified

²⁾ $I_F = -I_C$, $V_R = 600\text{ V}$, $-di/dt = 1000\text{ A}/\mu\text{s}$, $V_{GE} = 0\text{ V}$

³⁾ Use $V_{GEOff} = -5 \dots -15\text{ V}$

⁵⁾ See fig. 2 + 3; $R_{Goff} = 6,8\ \Omega$

⁶⁾ The free-wheeling diodes of the GAL and GAR types have the data of the inverse diodes of SKM 200 GB 123 D

⁷⁾ $V_{isol} = 4000\text{ V}_{rms}$ on request

⁸⁾ CAL = Controlled Axial Lifetime Technology.

Cases and mech. data → B6 - 64
SEMİTRANS 3

Absolute Maximum Ratings		Values		Units
Symbol	Conditions ¹⁾			
V_{CES}		1200		V
V_{CGR}	$R_{GE} = 20\text{ k}\Omega$	1200		V
I_C	$T_{case} = 25/80\text{ °C}$	150 / 100		A
I_{CM}	$T_{case} = 25/80\text{ °C}$; $t_p = 1\text{ ms}$	300 / 200		A
V_{GES}		± 20		V
P_{tot}	per IGBT, $T_{case} = 25\text{ °C}$	800		W
T_{j} , (T_{stg})		- 40 ... +150 (125)		°C
V_{isol}	AC, 1 min.	2 500 ⁷⁾		V
humidity	DIN 40 040	Class F		
climate	DIN IEC 68 T.1	55/150/56		
Inverse Diode				
$I_F = -I_C$	$T_{case} = 25/80\text{ °C}$	150 / 100	FWD ⁶⁾	A
$I_{FM} = -I_{CM}$	$T_{case} = 25/80\text{ °C}$; $t_p = 1\text{ ms}$	300 / 200	300 / 200	A
I_{FSM}	$t_p = 10\text{ ms}$; $\sin.$; $T_j = 150\text{ °C}$	1100	1450	A
I^2t	$t_p = 10\text{ ms}$; $T_j = 150\text{ °C}$	6000	10500	A ² s

Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
$V_{I(BR)CES}$	$V_{GE} = 0$, $I_C = 4\text{ mA}$	$\geq V_{CES}$	-	-	V
$V_{GE(th)}$	$V_{GE} = V_{CES}$, $I_C = 4\text{ mA}$	4,5	5,5	6,5	V
I_{CES}	$V_{GE} = 0$ $T_j = 25\text{ °C}$	-	0,2	2	mA
	$V_{CE} = V_{CES}$ $T_j = 125\text{ °C}$	-	9	-	mA
I_{GES}	$V_{GE} = 20\text{ V}$, $V_{CE} = 0$	-	-	1	μA
V_{CESat}	$I_C = 100\text{ A}$ $V_{GE} = 15\text{ V}$;	-	2,5(3,1)	3(3,7)	V
V_{CESat}	$I_C = 150\text{ A}$ $T_j = 25\text{ (125) °C}$	-	3(3,8)	-	V
g_{fs}	$V_{CE} = 20\text{ V}$, $I_C = 100\text{ A}$	54	-	-	S
C_{CHC}	per IGBT	-	-	700	pF
C_{ies}	$V_{GE} = 0$	-	6,5	8,5	nF
C_{oes}	$V_{CE} = 25\text{ V}$	-	1000	1500	pF
C_{res}	$f = 1\text{ MHz}$	-	500	600	pF
L_{CE}		-	-	20	nH
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	-	160	320	ns
t_r	$V_{GE} = +15\text{ V}$; - 15 V ³⁾	-	80	160	ns
$t_{d(off)}$	$I_C = 100\text{ A}$, ind. load	-	400	520	ns
t_f	$R_{Gon} = R_{Goff} = 6,8\ \Omega$	-	70	100	ns
E_{on} ⁵⁾	$T_j = 125\text{ °C}$	-	13	-	mW/s
E_{off} ⁵⁾		-	11	-	mW/s
Inverse Diode ⁸⁾					
$V_F = V_{EC}$	$I_F = 100\text{ A}$ $V_{GE} = 0\text{ V}$;	-	2,0(1,8)	2,5	V
$V_F = V_{EC}$	$I_F = 150\text{ A}$ $T_j = 25\text{ (125) °C}$	-	2,25(2,1)	-	V
V_{TO}	$T_j = 125\text{ °C}$	-	-	1,2	V
r_T	$T_j = 125\text{ °C}$	-	8	11	m Ω
I_{RRM}	$I_F = 100\text{ A}$; $T_j = 25\text{ (125) °C}$ ²⁾	-	35(50)	-	A
Q_{rr}	$I_F = 100\text{ A}$; $T_j = 25\text{ (125) °C}$ ²⁾	-	5(14)	-	μC
FWD of types "GAL", "GAR" ⁸⁾					
$V_F = V_{EC}$	$I_F = 100\text{ A}$ $V_{GE} = 0\text{ V}$;	-	1,85(1,6)	2,2	V
$V_F = V_{EC}$	$I_F = 150\text{ A}$ $T_j = 25\text{ (125) °C}$	-	2,0(1,8)	-	V
V_{TO}	$T_j = 125\text{ °C}$	-	-	1,2	V
r_T	$T_j = 125\text{ °C}$	-	5	7	m Ω
I_{RRM}	$I_F = 100\text{ A}$; $T_j = 25\text{ (125) °C}$ ²⁾	-	40(65)	-	A
Q_{rr}	$I_F = 100\text{ A}$; $T_j = 25\text{ (125) °C}$ ²⁾	-	5(15)	-	μC
Thermal Characteristics					
R_{thjc}	per IGBT	-	-	0,16	°C/W
R_{thjc}	per diode / FWD "GAL"; "GAR"	-	-	0,30/0,25	°C/W
R_{thch}	per module	-	-	0,038	°C/W

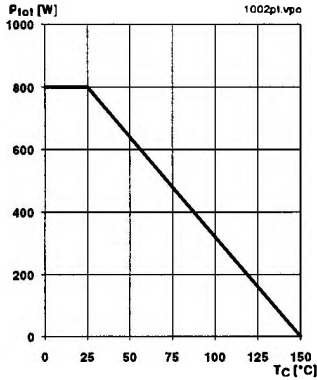


Fig. 1 Rated power dissipation $P_{tot} = f(T_c)$

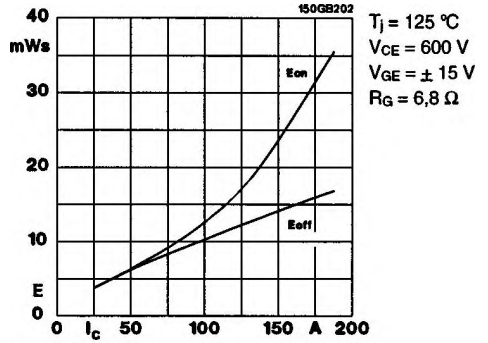


Fig. 2 Turn-on /-off energy = $f(I_c)$

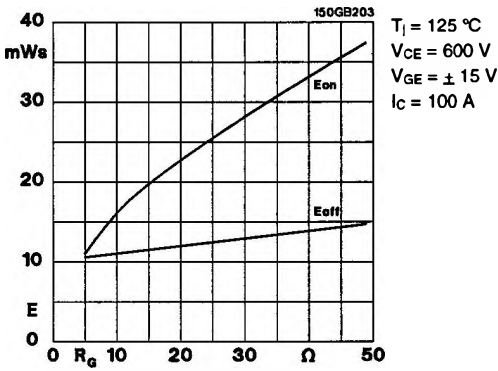


Fig. 3 Turn-on /-off energy = $f(R_G)$

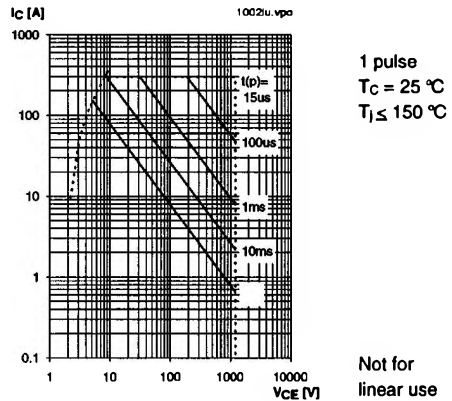


Fig. 4 Maximum safe operating area (SOA) $I_c = f(V_{CE})$

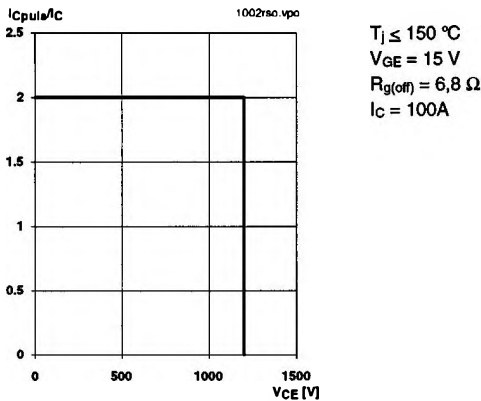


Fig. 5 Turn-off safe operating area (RBSOA)

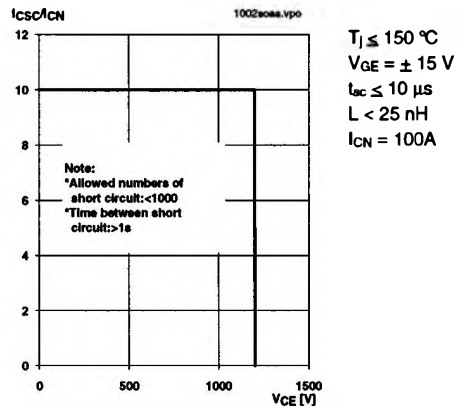
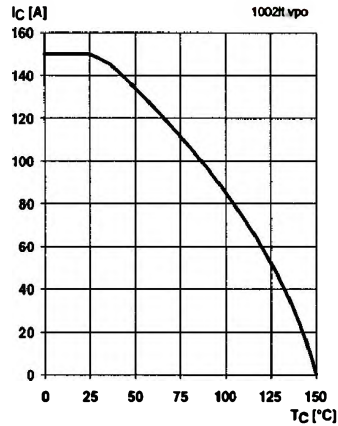


Fig. 6 Safe operating area at short circuit $I_c = f(V_{CE})$



$T_J = 150\text{ }^\circ\text{C}$
 $V_{GE} \geq 15\text{ V}$

Fig. 8 Rated current vs. temperature $I_c = f(T_c)$

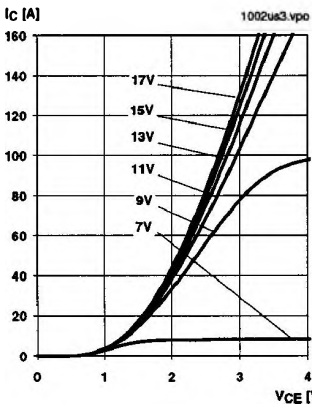


Fig. 9 Typ. output characteristic, $t_p = 80\text{ }\mu\text{s}$; $25\text{ }^\circ\text{C}$

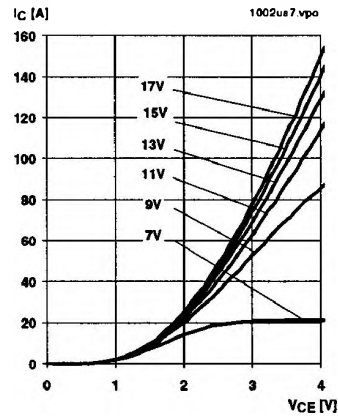


Fig. 10 Typ. output characteristic, $t_p = 80\text{ }\mu\text{s}$; $125\text{ }^\circ\text{C}$

$$P_{cond(t)} = V_{CEsat(t)} \cdot I_{c(t)}$$

$$V_{CEsat(t)} = V_{CE(To)(Tj)} + r_{CE(Tj)} \cdot I_{c(t)}$$

$$V_{CE(To)(Tj)} \leq 1.5 + 0.002 (T_j - 25) \text{ [V]}$$

$$r_{CE(Tj)} = 0.010 + 0.00004 (T_j - 25) \text{ [\Omega]}$$

$$\text{valid for } V_{GE} = +15 \frac{+2}{-1} \text{ [V]; } I_c > 0.3 I_{Cnom}$$

Fig. 11 Typ. saturation characteristic (IGBT)
 Calculation elements and equations

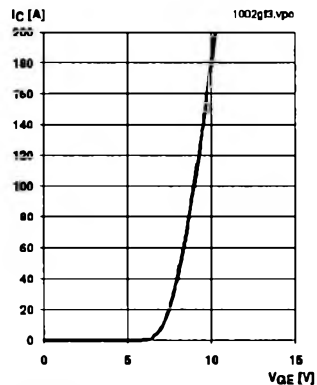


Fig. 12 Typ. transfer characteristic, $t_p = 80\text{ }\mu\text{s}$; $V_{CE} = 20\text{ V}$

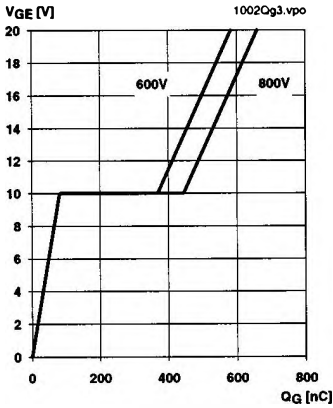
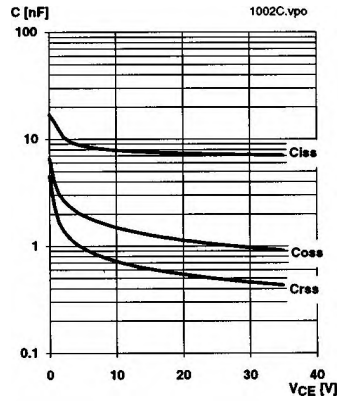


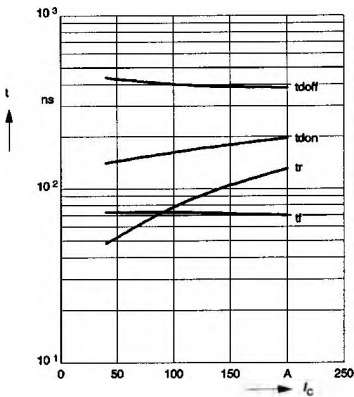
Fig. 13 Typ. gate charge characteristic

$I_{Cpuls} = 100 \text{ A}$



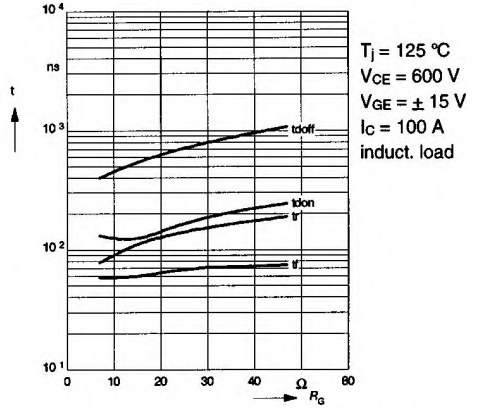
$V_{GE} = 0 \text{ V}$
 $f = 1 \text{ MHz}$

Fig. 14 Typ. capacitances vs. V_{CE}



$T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 6,8 \text{ } \Omega$
 $R_{goff} = 6,8 \text{ } \Omega$
induct. load

Fig. 15 Typ. switching times vs. I_C



$T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 100 \text{ A}$
induct. load

Fig. 16 Typ. switching times vs. gate resistor R_g

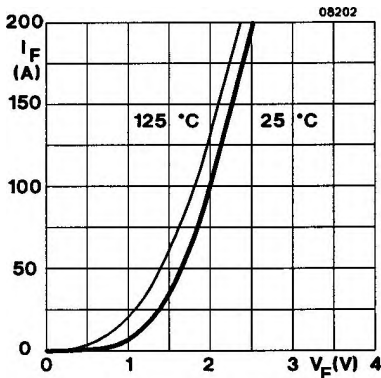


Fig. 17 Typ. CAL diode forward characteristic

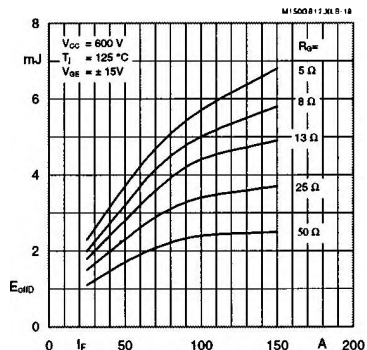


Fig. 18 Diode turn-off energy dissipation per pulse

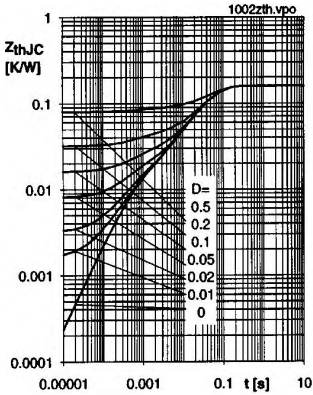


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

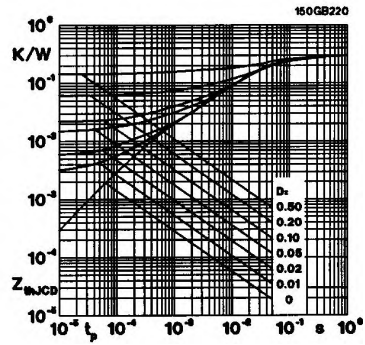


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

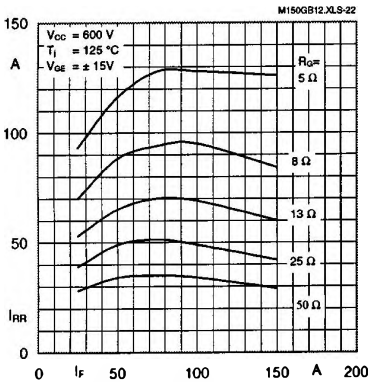


Fig. 22 Typ. CALdiode reverse recovery current $I_{RR} = f(I_F; R_G)$

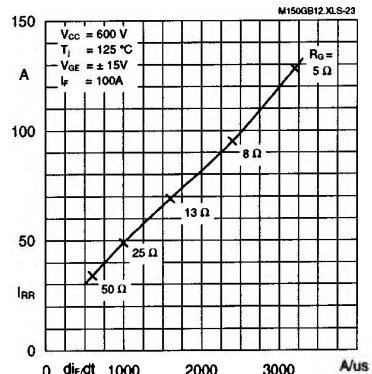


Fig. 23 Typ. CAL diode reverse recovery current $I_{RR} = f(di/dt)$

Typical Applications include

- Switched mode power supplies
- DC servo and robot drives
- Inverters
- DC choppers (versions GAL and GAR)
- AC motor speed control
- Inductive heating
- UPS Uninterruptable power supplies
- General power switching applications
- Electronic (also portable) welders
- Pulse frequencies also above 15 kHz

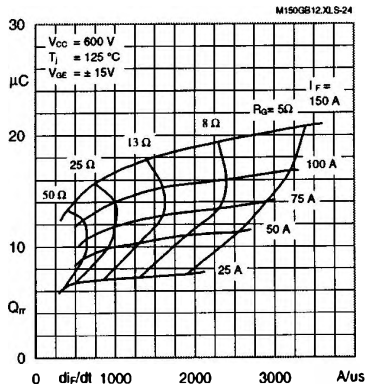


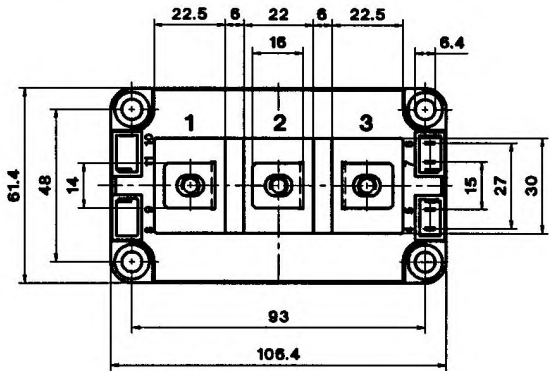
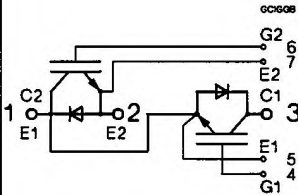
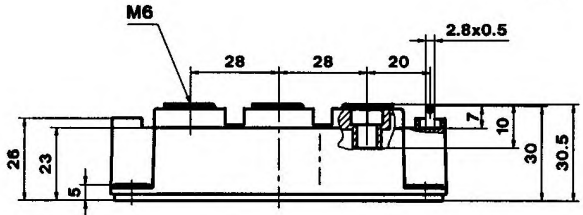
Fig. 24 Typ. CAL diode recovered charge $Q_{rr} = f(di/dt)$

SEMISTRANS 3

Case D 56
UL Recognized
File no. E 63 532

CASED56

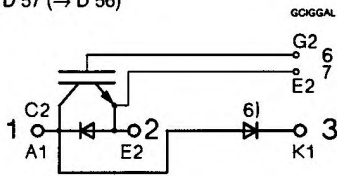
SKM 150 GB 123 D
SKM 150 GB 173 D



Dimensions in mm

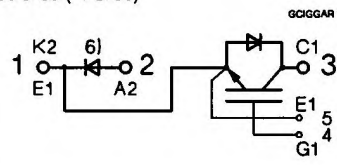
SKM 150 GAL 123 D

Case D 57 (→ D 56)



SKM 150 GAR 123 D

Case D 58 (→ D 56)



Case outline and circuit diagrams

Mechanical Data		Values			Units
Symbol	Conditions	min.	typ.	max.	
M ₁	to heatsink, SI Units (M6)	3	-	5	Nm
	to heatsink, US Units	27	-	44	lb.in.
M ₂	for terminals, SI Units (M6)	2,5	-	5	Nm
	for terminals US Units	22	-	44	lb.in.
a		-	-	5x9,81	m/s ²
w		-	-	420	g

This is an electrostatic discharge sensitive device (ESDS). Please observe the International standard IEC 747-1, Chapter IX.

Three devices are supplied in one SEMIBOX B without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMISTRANS 3). Larger packing units of 12 and 20 pieces are used if suitable

Accessories → page B 6 - 4.
SEMIBOX → page C - 1.

⁶⁾ Freewheeling diode → page B 6 - 59, remark 6.